Class B Power Amplifier

- The biasing of the transistor in class B operation is in such a way that at zero signal condition, there will be no collector current. The **operating point** is selected to be at collector cut off voltage. So, when the signal is applied, **only the positive half cycle** is amplified at the output.
- The figure below shows the input and output waveforms during class B operation.

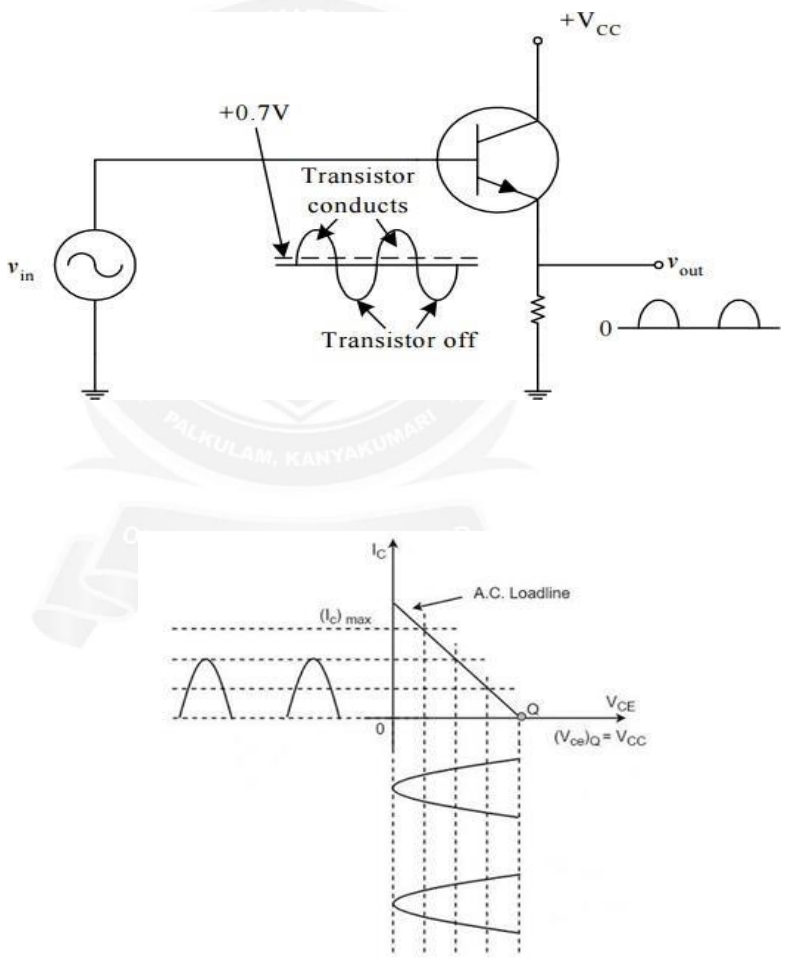


Fig.1 Class B Amplifier

(Source: Microelectronics byJ. Millman and A. Grabel,)

- When the signal is applied, the circuit is forward biased for the positive half cycle of the input and hence the collector current flows. But during the negative half cycle of the input, the circuit is

reverse biased and the collector current will be absent. Hence **only the positive half cycle** is amplified at the output.

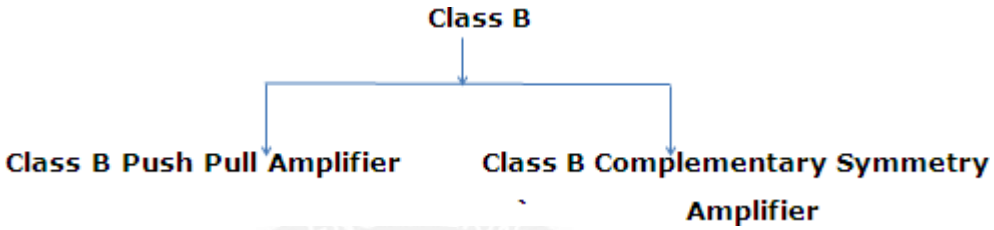
- As the negative half cycle is completely absent, the signal distortion will be high. Also, when the applied signal increases, the power dissipation will be more. But when compared to class A power amplifier, the output efficiency is increased. Well, in order to minimize the disadvantages and achieve low distortion, high efficiency and high output power, the push-pull configuration is used in this class B amplifier.
- The output power is obtained for one half cycle of input only. Refer Figure .The collector current flows for 180 degrees only. For this the Q point is adjusted so that it is in cut off region (refer figure).
- The transistor conducts one half cycle only for the positive half cycle of the input and in Negative cycle of input the transistor goes into Off state. Thus collector current flows only for one half cycle.
- Since the transistor conducts for one half cycle of the input the power dissipation of these class B amplifiers are very less. Hence efficiency gets increased.
- The class B amplifier is biased at the cutoff point so that
- It is brought out of cutoff and operates in its linear region when the input signal drives the transistor into conduction.

Advantages:

- Impedance with load is possible.
- Second harmonic get automatically cancelled.
- Zero power dissipation.
- High efficiency compared with class A amplifiers.

Disadvantage:

- Crossover distortion is present in the output waveform. Since, the transistor is biased at cut off region the waveform is distorted near zero crossings.
- Efficiency is not so high.



- **Push Pull Amplifier** - If both the transistors are of same type (NPN or PNP)

- **Complementary Symmetry**- If one of the transistors is NPN & the other one PNP or vice versa.

CLASS B PUSH PULL POWER AMPLIFIER:

- Though the efficiency of class B power amplifier is higher than class A, as only one half cycle of the input is used, the distortion is high. Also, the input power is not completely utilized. In order to compensate these problems, the push-pull configuration is introduced inclass B amplifier.
- In class B amplifier output collector current flows only for half cycle for full cycle of the input hence distortion. To get out for full input signal we use Push Pull circuit. Two transformers are used in Push pull amplifiers,one at the input and the other at the load side.

Construction:

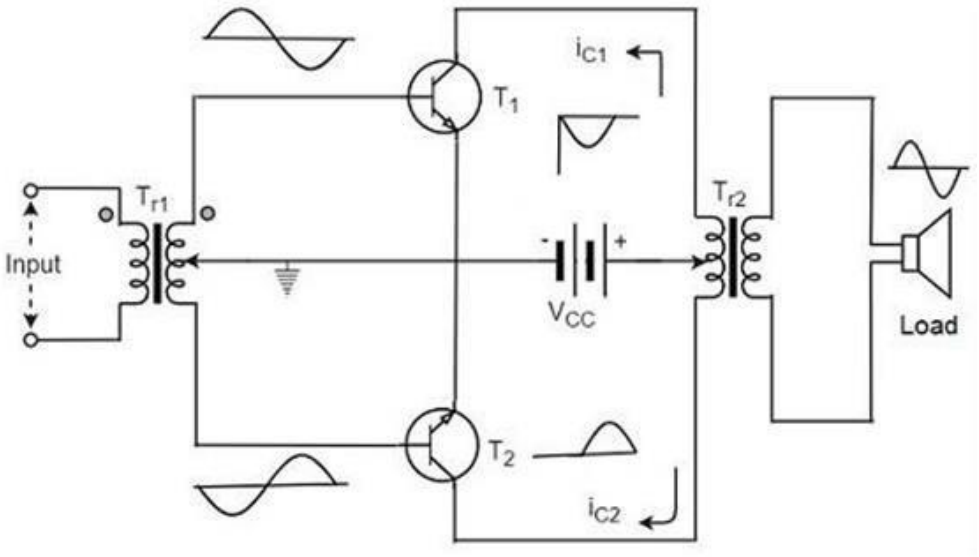


Fig 2 Push-pull class B power amplifier

(Source: Microelectronics byJ. Millman and A. Grabel,)

- The circuit of a push-pull class B power amplifier consists of two identical transistors T1 and T2 whose bases are connected to the secondary of the center-tapped input transformer T_{r1}. The emitters are shorted and the collectors are given the V_{CC} supply through the primary of the output transformer T_{r2}.
- The circuit arrangement of class B push-pull amplifier, is same as that of class A push-pull amplifier except that the transistors are biased at cut off, instead of using the biasing resistors. The figure below gives the detailing of the construction of a push-pull class B power amplifier.
- The circuit operation of class B push pull amplifier is detailed below.

Operation

- The circuit of class B push-pull amplifier shown in the above figure clears that both the transformers are center-tapped. When no signal is applied at the input, the transistors T1 and T2 are in cut off condition and hence no collector currents flow. As no current is drawn from V_{CC}, no power is wasted.

- When input signal is given, it is applied to the input transformer Tr1 which splits the signal into two signals that are 180^o out of phase with each other. These two signals are given to the two identical transistors T1 and T2. For the positive half cycle, the base of the transistor T1 becomes positive and collector current flows. At the same time, the transistor T2 has negative half cycle, which throws the transistor T2 into cutoff condition and hence no collector current flows. The waveform is produced as shown in the following figure.

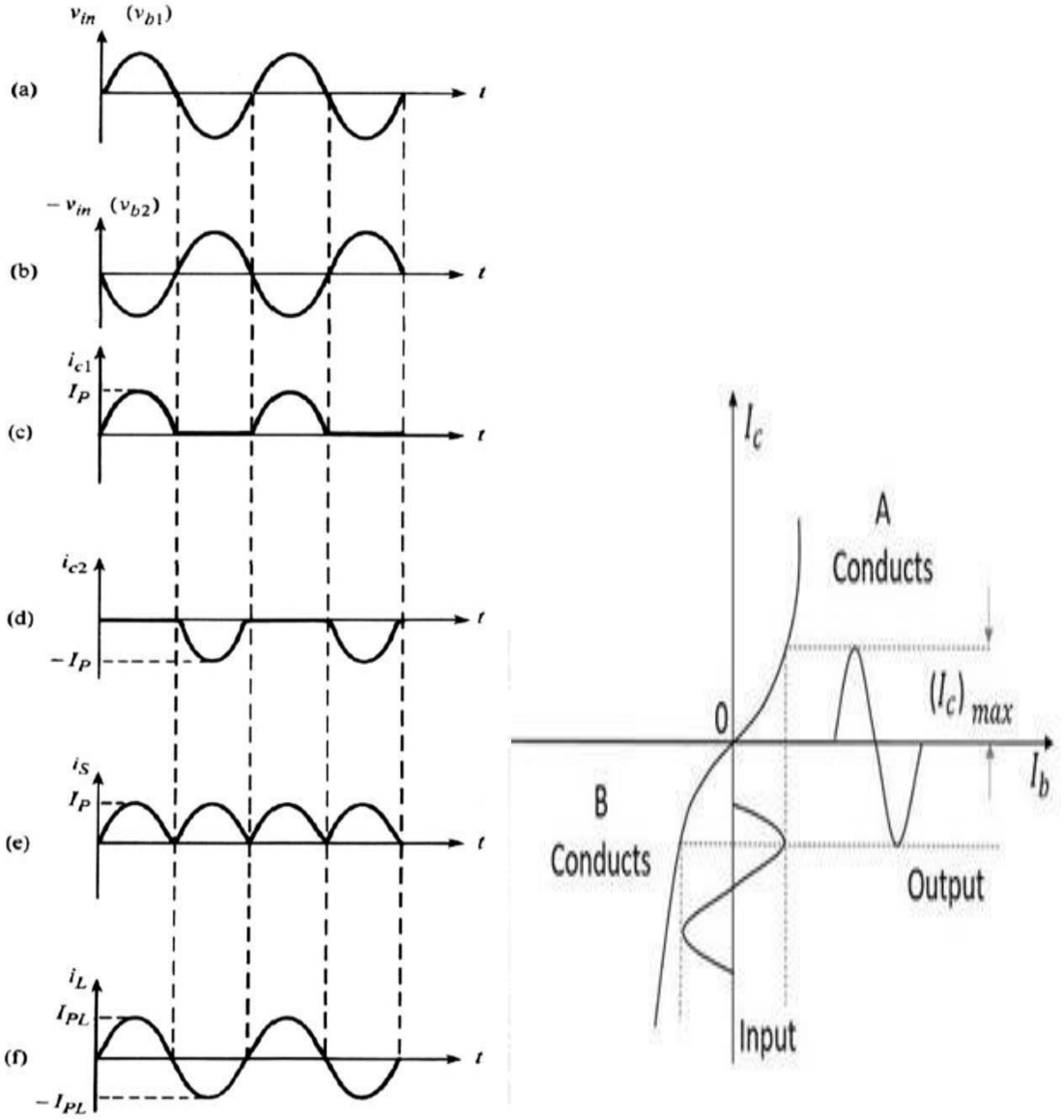


Fig.3 Push-pull class B power amplifier wave forms

(Source: Microelectronics byJ. Millman and A. Grabel,)

For the next half cycle, the transistor T1 gets into cut off condition and the transistor T2 gets into conduction, to contribute the output. Hence for both the cycles, each transistor conducts alternately. The output transformer Tr3 serves to join the two currents producing analmost undistorted output waveform.